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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/532,963	04/27/2005	Kaoru Fukuda	108421-00117	9022

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EXAMINER	
ENIN-OKUT, EDU E	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
01/07/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/532,963	FUKUDA ET AL.	
	Examiner	Art Unit	
	Edu E. Enin-Okut	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 September 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

ELECTRODE STRUCTURE FOR SOLID POLYMER TYPE FUEL CELL

Detailed Action

1. The amendment filed on September 30, 2008 was received. Claims 1, 4 and 5 have been amended. Claims 1-6 are pending.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in the prior Office action issued on June 30, 2008.

Specification

3. The objections made with respect to the abstract and the disclosures are withdrawn due to amendments made to the above-described portions of the specification.

Claim Objections

4. The objection to claims 1, 4 and 5 is withdrawn because claims 1, 4 and 5 have been amended.

Claim Rejections - 35 USC § 103

5. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over Haridoss et al., U.S. Patent No. 6,821,661 in view of Fukuda et al., U.S. Patent Application Publication No. 2002/0064699 and Kaiser et al., U.S. Patent Application Publication No. 2002/0068213 on claims 1,4 are maintained. The rejection is repeated below for convenience.

Regarding claim 1, Haridoss teaches a membrane electrode assembly [602] for a polymer electrolyte fuel cell (Abstract; Fig, 6), comprising:

- a polymer electrolyte membrane (1:56-58; 7:52-53); and

- an anode and a cathode each having a catalytic layer and a diffusion layer [604,606] (Abstract; 1:56-58; Fig. 6),

the anode diffusion layer [604] further comprising:

- a carbon-based material (3:32-33, 4:48-49); and
- a water holding layer thereon (4:49-54; 7:45-47).

However, Haridoss does not expressly teach that a water holding layer thereon containing water holding material for 5 to 20 wt % of total weight of an electron conductive material and the water holding material, or carbon particles having water absorption amount at saturated water vapor pressure at 60 °C of not less than 150 cc/g; the water absorption ratio of the anode diffusion layer at 60 °C is in a range of 40 to 85%; or, a differential pressure of the anode diffusion layer measured by the differential pressure measuring method is in a range of 60 to 120 mmAq; or, a ratio of quantity of electric charge of catalytic material of the cathode catalytic layer existing in a proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode catalytic layer.

As to a water holding layer thereon containing water holding material for 5 to 20 wt % of total weight of an electron conductive material and the water holding material, or carbon particles having water absorption amount at saturated water vapor pressure at 60 °C of not less than 150 cc/g, Fukuda teaches that carbon black particles in a fuel electrode of a solid polymer fuel cell has a hydrophilic property such that an amount of water adsorbed under a saturated steam pressure at 60 °C is equal to or larger than 150 cc/g (para. 13).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the water holding material of Fukuda in the water holding layer of Haridoss to ensure the proton conductivity of the electrolyte membrane by maintaining it in a wet state via retaining water in the anode side of the fuel cell (see Fukuda, para. 6, 18).

As to the water absorption ratio of the anode diffusion layer at 60 °C is in a range of 40 to 85%, Applicant states that, if the anode diffusion layer has a water holding layer containing carbon particles having water absorption amount at saturated water vapor pressure at 60 °C of not less than 150 cc/g, the water absorption ratio of the anode diffusion layer at 60 °C is in a range of 40 to 85% in Paragraph 11 of its disclosure.

Therefore, one of ordinary skill in the art would appreciate that the anode diffusion layer of Haridoss, as modified by Fukuda, would be capable of absorbing water, in the manner recited by the language of claim, due the nature of the water-holding material being such that such the amount of water adsorbed under a saturated steam pressure at 60 °C is equal to or larger than 150 cc/g.

As to a differential pressure of the anode diffusion layer measured by the differential pressure measuring method is in a range of 60 to 120 mmAq, this limitation has been considered, and construed as a functional limitation that adds no additional structure to the diffusion layer claimed. See MPEP 2144.

However, Haridoss also teaches the polymer electrolyte fuel cell fuel cell has an anode differential pressure less than 1 psig (4:61-63).

It has been held that obviousness exists where the claimed ranges overlap or lie inside ranges disclosed by the prior art (e.g., *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990)). See MPEP 2144.05 (I). Thus, one of ordinary skill in the art would have found it obvious that the polymer electrolyte fuel cell of Haridoss can be operated in a manner in which its anode diffusion layer would exhibit a differential pressure of that recited by the functional language of the claim (see Haridoss, 5:65-6:4).

As to a ratio of quantity of electric charge of catalytic material of the cathode catalytic layer existing in a proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode catalytic layer, Applicant has stated that the appropriate degree of adhesion

between the polymer electrolyte membrane and the anode catalytic layer is expressed by a measured value obtained via the cyclic voltammetric method in Paragraph 22 of its disclosure.

Kaiser teaches that a base application of an electrocatalyst layer, through the decal method, can be used to maintain a strong ionomer contact and mechanical adhesion between the catalyst layer and the ionomer electrolyte or membrane of a fuel cell (Abstract; para. 23).

It has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (e.g., *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)). See MPEP 2144.05 (II).

Therefore, one of ordinary skill in the art would have found it obvious to obtain the ratio of quantity of electric charge of catalytic material as recited the claim by sufficiently adhering the catalytic material of Haridoss to its diffusion layer using the method taught by Kaiser because it is known in the art as a way to produce a strong bond between the catalyst layer and the polymer membrane of a membrane electrode assembly.

Regarding claim 4, the limitations recited in this claim have been addressed above with respect to claim 1 except a carbon-material having a contact angle with water of not more than 90° by performing a hydrophilic treatment; and, a penetration resistance measured by a penetration resistance method is not more than 5 mΩ.

As to the carbon-material having a contact angle with water of not more than 90° by performing a hydrophilic treatment, Haridoss, discussed above, teaches an anode gas diffusion layer, formed by either impregnating a carbon paper with a hydrophilic material or placing a layer of that material on the paper, has with a contact angle with water less than 100° (Abstract; 7:38-40, 7:45-56).

Since it has been held that obviousness exists where the claimed ranges overlap or lie inside ranges disclosed by the prior art (see MPEP 2144.05 (I)), it would have been obvious to one of ordinary skill in the art at the time of the invention to use a carbon-material with a contact angle as taught by

Haridoss, as modified by Fukuda, to produce an anode diffusion layer that promotes water transfer through a fuel cell (see Haridoss, 4:21-23).

As to a penetration resistance measured by a penetration resistance method is not more than 5 mΩ, Applicant has stated that electrode assembles "in which water absorption amount of carbon particles, water absorption ratio of the anode diffusion layer, differential pressure, and adhesion ratio are within the range of the present invention, have penetration resistance of not more than mΩ" in Paragraph 85 of its disclosure.

Thus, one would appreciate that the membrane electrode assembly of Haridoss, as modified by Fukuda and Kaiser, is capable of a penetration resistance as recited in claim 4 because each of the characteristics of required of the electrode assembly have been addressed here and above with respect to claim 1.

6. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over Haridoss et al., U.S. Patent No. 6,821,661 in view of Fukuda et al., U.S. Patent Application Publication No. 2002/0064699 and Kaiser et al., U.S. Patent Application Publication No. 2002/0068213 as applied to claims 1,4 and further in view of Taniguchi et al. (US 6,083,638) on claim 2 are maintained. The rejection is repeated below for convenience.

Haridoss, Fukuda and Kaiser are applied and incorporated herein for the reasons above.

Regarding claim 2, Haridoss teaches that the anode diffusion layer [604] (Fig. 6) comprising a carbon-based material (3:32-33, 4:48-49). Fukuda teaches a layer thereon having carbon particles, a polymer electrolyte, and water holding material (para. 13).

However, Haridoss, Fukuda, and Kaiser do not expressly teach one layer thereon having carbon particles and fluorine resin; or, a second layer thereon including a void forming agent.

As to one layer thereon having carbon particles and fluorine resin, Tosco teaches a double-layered electrodes with a highly hydrophobic carbon support layer coupled to a lesser hydrophobic layer (also known as the active layer) containing catalyzed carbon and suitable binders (1:18-23). Water-repellent structures of the diffusion layer are generally achieved by coating the surface of some carbon particles with a hydrophobic material, such as polytetrafluoroethylene (e.g., Teflon®) (1:65-2:5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to include a layer with carbon and fluorine resin as taught by Tosco in the anode diffusion layer of Haridoss, as modified by Fukuda and Kaiser, to provide channels for reactant gas to diffuse through the pores to the electro-active layer of an electrode while barring the penetration of electrolyte (see Tosco, 2:24-27).

As to a second layer thereon including a void forming agent, Taniguchi teaches a current collector 40 (i.e., a diffusion layer) for an anode 12 that are made by loading bulking agents into a porous substrate of proper strength (3:53-54).

One of ordinary skill in the art the time of the invention would have found it obvious to include a void-forming agent into the a second layer of the anode diffusion layer of Haridoss as taught by Taniguchi, because the porosity created allows for reactant gases to pass through the layer while supplying water to and humidifying the polymer electrolyte (see Taniguchi, 8:58-67).

7. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over Haridoss et al., U.S. Patent No. 6,821,661 in view of Fukuda et al., U.S. Patent Application Publication No. 2002/0064699 and Kaiser et al., U.S. Patent Application Publication No. 2002/0068213 as applied to claims 1,4, and further in view Tosco et al. (US 6,280,871) on claim 3 are maintained. The rejection is repeated below for convenience.

Haridoss, Fukuda, Kaiser and Tosco are applied and incorporated herein for the reasons above.

Regarding claim 3, Haridoss teaches the anode diffusion layer [604] (Fig. 6) comprising a carbon-based material (3:32-33, 4:48-49). The reference also teaches a layer thereon including carbon particles and a water holding material (7:34-37; 7:46-50).

However, Haridoss, Fukuda, and Kaiser do not expressly teach that the layer thereon includes a fluorine resin.

Tosco, discussed above, also teaches a common method to make carbon partly hydrophilic (i.e., semi-hydrophilic) consists in preparing an alcohol mixture of the carbon powder (with or without catalyst) and a hydrophilic fluorinated resin (2:35-38).

One of ordinary skill in the art at the time of the invention would have found it obvious to include the hydrophilic fluorinated resin of Tosco in the layer of Haridoss, as modified by Fukuda and Kaiser, to add a hydrophilic characteristic that can assist in efforts to maintain proper humidification of the cell while maintaining some of the hydrophobic characteristics of the layer for the reasons discussed above with respect to claim 2.

8. The claim rejections under 35 U.S.C. 103(a) as being unpatentable over Haridoss et al., U.S. Patent No. 6,821,661 in view of Fukuda et al., U.S. Patent Application Publication No. 2002/0064699 and Kaiser et al., U.S. Patent Application Publication No. 2002/0068213 as applied to claims 1,4, and further in view of Saito (JP 10-223233) and Matsubara et al. (US 2003/0072991) on claims 5,6 are maintained. The rejection is repeated below for convenience.

Regarding claim 5, Fukuda teaches a catalytic layer comprising at least a catalyst, carbon particles supporting the catalyst, and a polymer electrolyte (para. 13).

The remaining limitations recited in this claim have been addressed above with respect to claims 1, 2 and 3 except the cathode catalytic layer further containing a void forming agent.

As to this limitation, Saito teaches an electrode for a fuel cell with high in catalyst efficiency by providing a catalyst layer, containing carbon fibers together with the catalyst, a water repellent, a solid polymer electrolyte on the surface of a porous base body to allow the solid components in the catalyst layer to be entangled with the carbon fiber and to prevent the solid components from entering the porous base body (Abstract).

One of ordinary skill in the art the time of the invention would have found it obvious to include a void-forming agent (e.g., carbon fiber) as taught by Saito into the cathode catalytic layer of Haridoss, as modified by Fukuda, because the porosity created allows for reactant gases to pass through the layer and, in turn, supply fuel gas and oxidizing gas uniformly to the entirety of a catalytic layer to improve generation efficiency (see Matsubara et al., para. 4).

Regarding claim 6, the limitations recited in this claim have been addressed above with respect to claim 4 except the carbon-based material of the cathode diffusion layer has a contact angle with water of not less than 130° by performing a water-repellent treatment.

As to this limitation, Haridoss teaches the carbon-based material of the cathode diffusion layer has a contact angle with water of not less than 130° by performing a water-repellent treatment (3:32-33, 4:32-35; 7:64-8:4; claim 5).

Response to Arguments

9. Applicant's arguments filed September 26, 2008 have been fully considered but they are not persuasive.

In response to applicant's argument that the catalyst-coated carbon particles of Fukuda could not be bodily incorporated in the diffusion layer of Haridoss (e.g., see applicant's remarks on p. 16-17), the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in

any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In this case, one of ordinary skill in the art would readily appreciate that the carbon particles of Fukuda themselves, having a hydrophilic property such that an amount of water adsorbed under a saturated steam pressure at 60 °C is equal to or larger than 150 cc/g, could be used in other components of a fuel cell to impart those properties to that component. (See the rejection of claim 1, as amended, above.)

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Correspondence / Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Edu E. Enin-Okut** whose telephone number is **571-270-3075**. The examiner can normally be reached on Monday - Thursday, 7 a.m. - 3 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edu E Enin-Okut/
Examiner, Art Unit 1795

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1795